

Claims

- [c1] A process for lowering fluorine content after metal fill and planarization of a metal conductor and fluorine-containing dielectric wire structure, comprising:
generating atomic hydrogen species; and
exposing the fluorine-containing dielectric to the atomic hydrogen species in an amount effective to lower the fluorine content in the fluorine-containing dielectric.
- [c2] The process of Claim 1, wherein lowering the fluorine content comprises removing fluorine from a surface of the fluorine-containing dielectric to a depth less than or equal to about 20 percent of a thickness of the fluorine-containing dielectric.
- [c3] The process of Claim 1, wherein lowering the fluorine content comprises removing fluorine from a surface of the fluorine-containing dielectric to a depth less than or equal to about 10 percent of a thickness of the fluorine-containing dielectric.
- [c4] The process of Claim 1, wherein lowering the fluorine content comprises removing fluorine from a surface of the fluorine-containing dielectric to a depth less than or equal to about 5 percent of a thickness of the fluorine-containing dielectric.
- [c5] The process of Claim 1, wherein lowering the fluorine content comprises removing fluorine from at least about 200 angstroms from a surface of the fluorine-containing dielectric.

- [c6] The process of Claim 1, wherein lowering the fluorine content comprises removing fluorine from at least about 500 angstroms from a surface of the fluorine-containing dielectric.
- [c7] The process of Claim 1, wherein lowering the fluorine content comprises removing fluorine from at least about 700 angstroms from a surface of the fluorine-containing dielectric.
- [c8] The process of Claim 1, wherein generating atomic hydrogen species comprises energizing a hydrogen bearing gas to form plasma containing the atomic hydrogen species or heating the hydrogen bearing gas in a furnace to generate the atomic hydrogen species.
- [c9] The process of Claim 1, wherein the metal conductor comprises a copper metal.
- [c10] The process of Claim 1, wherein the fluorine content at about a surface of the fluorine-containing dielectric is less than about 2 percent after exposing the fluorine-containing dielectric to the atomic hydrogen species.
- [c11] The polish process of Claim 1, wherein the fluorine-containing dielectric comprises a fluorinated diamond like carbon dielectric, a fluorinated diamond like carbon dielectric with additives selected from the group consisting of hydrogen, silicon germanium, nitrogen and oxygen, fluorinated silicon oxide, fluorinated silicon glass, organo-inorganic dielectrics

containing fluorine, or organic dielectrics containing fluorine.

[c12] The process of Claim 11, wherein the plasma is formed from a gas mixture comprising a hydrogen-bearing compound.

[c13] The process of Claim 11, wherein the hydrogen bearing compound comprises a hydrocarbon, a hydrofluorocarbon, a hydrogen gas, a water vapor, ammonia, or mixtures comprising at least one of the foregoing hydrogen bearing compounds.

[c14] The process of Claim 13, wherein hydrogen gas comprises a mixture of the hydrogen gas with an inert gas.

[c15] A process for forming a wiring structure including a copper metal conductor and a fluorine-containing dielectric, comprising:
forming a gap in a layer of the fluorine-containing dielectric;
overfilling the gap with the copper metal conductor;
planarizing and removing the copper metal conductor above the fluorine-containing dielectric to expose a surface of the fluorine-containing dielectric;
forming a plasma from a hydrogen bearing gas to generate atomic hydrogen species;
exposing the surface of the fluorine-containing dielectric to the atomic hydrogen species; and
removing fluorine from and about the surface of the fluorine-

containing dielectric.

- [c16] The process according to Claim 15, wherein the hydrogen bearing gas comprises a hydrocarbon, a hydrofluorocarbon, a hydrogen gas, a water vapor, ammonia, or mixtures comprising at least one of the foregoing hydrogen bearing compounds.
- [c17] The process according to Claim 15, wherein exposing the surface of the fluorine-containing dielectric lowers the fluorine in at least about 200 angstroms from the surface of the fluorine-containing dielectric.
- [c18] The process according to Claim 15, wherein exposing the surface of the fluorine-containing dielectric lowers the fluorine in at least about 500 angstroms from the surface of the fluorine-containing dielectric.
- [c19] The process according to Claim 15, wherein exposing the surface of the fluorine-containing dielectric lowers the fluorine in at least about 700 angstroms from the surface of the fluorine-containing dielectric.
- [c20] The process according to Claim 15, wherein exposing the surface of the fluorine-containing dielectric lowers an amount of the fluorine from the surface to a depth less than or equal to about 20 percent of a thickness of the fluorine-containing dielectric.

- [c21] The process according to Claim 15, wherein the fluorine-containing dielectric comprises a fluorinated diamond like carbon dielectric, a fluorinated diamond like carbon dielectric with additives selected from the group consisting of hydrogen, silicon germanium, nitrogen and oxygen, fluorinated silicon oxide, fluorinated silicon glass, organo-inorganic dielectrics containing fluorine, or organic dielectrics containing fluorine.
- [c22] The process according to Claim 15, wherein exposing the surface of the fluorine-containing dielectric lowers an amount of the fluorine from and about the surface to less than about 2 percent.
- [c23] A process for lowering fluorine content after metal fill and planarization of a metal conductor and fluorine-containing dielectric wire structure, comprising:
generating atomic nitrogen species; and
exposing the fluorine-containing dielectric to the atomic nitrogen species in an amount effective to lower the fluorine content in the fluorine-containing dielectric.